Modern Engineering

Day 14

Prudential Financial

GENERAL ASSEMBLY

LESSON ROADMAP

Continuous Integration

CI/CD Pipelines

Writing a Jenkins pipeline

Jenkins + ToDo List

MEF MODULE 5 DAY 14: CI/CD Pipelines with Jenkins

Schedule	
9:00–9:15 am	Welcome and Warm-Up
9:15–10:00 am	Continuous Integration and Github
10:00 am–12:30 pm	**Jenkins CI/CD Walkthrough**
12:30–1:30 pm	Lunch
1:30-4:50 pm	**Open Lab and Review Time**
4:50–5:00 pm	Bring It Home

LEARNING OBJECTIVES

1. Explain the relationship between git and continuous integration/continuous deployment (CI/CD)
2. Build a functional CI/CD pipeline using Jenkins
3. Explain the benefits of CI/CD in the Software Development Cycle
4. Apply CI/CD to automated testing and deployment in an Express application

Modern Engineering

Continuous Integration and Git

CI/CD

Continuous integration (CI) and **continuous delivery** (CD) are used to build, test, and deploy software quickly and safely, ultimately delivering value to your users more quickly.

Generally, companies begin with **continuous integration**.

Continuous delivery goes a step further than CI by automating the deployment of releases. This includes infrastructure and configuration changes.

Continuous deployment goes a step further than continuous delivery by deploying every change to production automatically.

Commit Small Changes *Often*

It is best practice for developers to commit to the mainline branch *often*.

- Changes should be as small as possible
- ***If the build breaks***, anyone can quickly pinpoint the specific issue

With many changes happening all the time, a fast build process is critical, so developers can get feedback about broken builds right away.

Quick Question:

How ***often*** do you think a developer should be pushing their changes to the mainline branch?

Come off of mute or type your answer in the chat!

Discussion:

Why is CI/CD Important?

10 Minutes

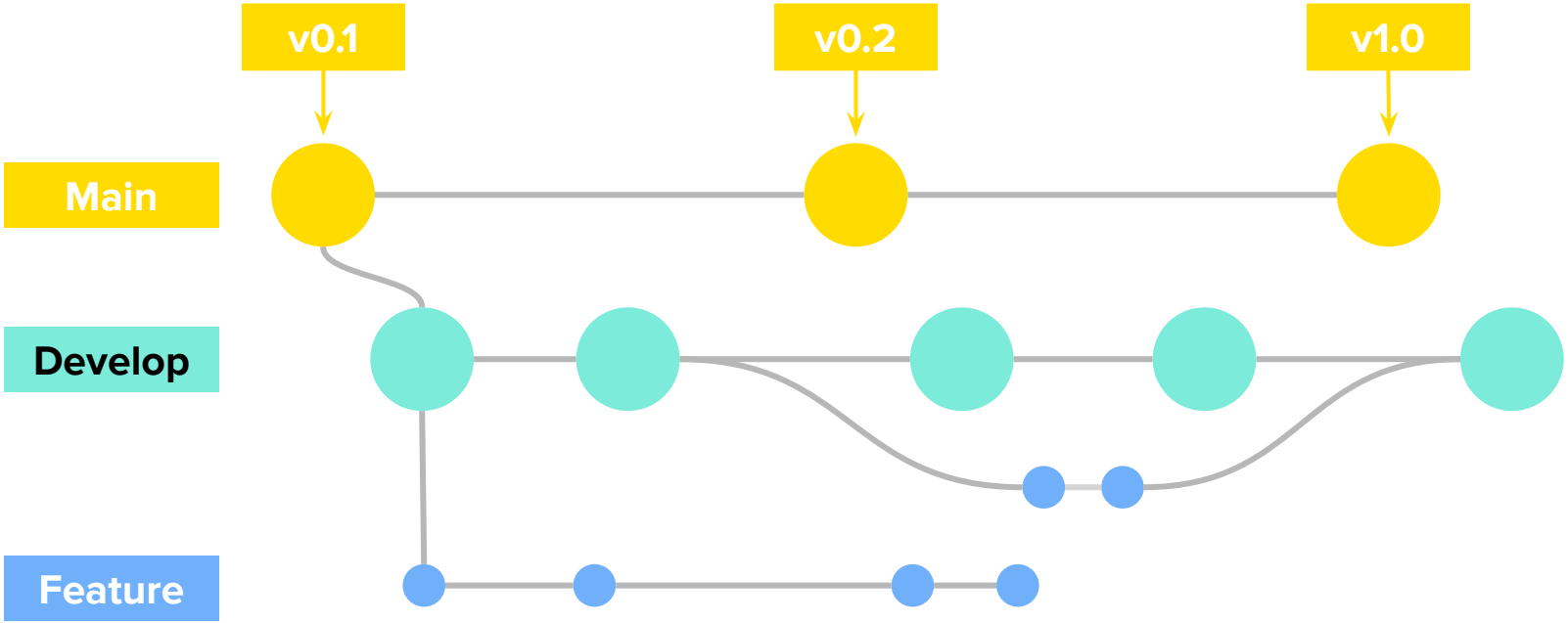
Consider how *often* we make changes to the mainline branch in CI/CD.

What would be the biggest issue if we were making larger changes, less often?

What might be the overall impact to build and development process?

Come off mute and discuss!

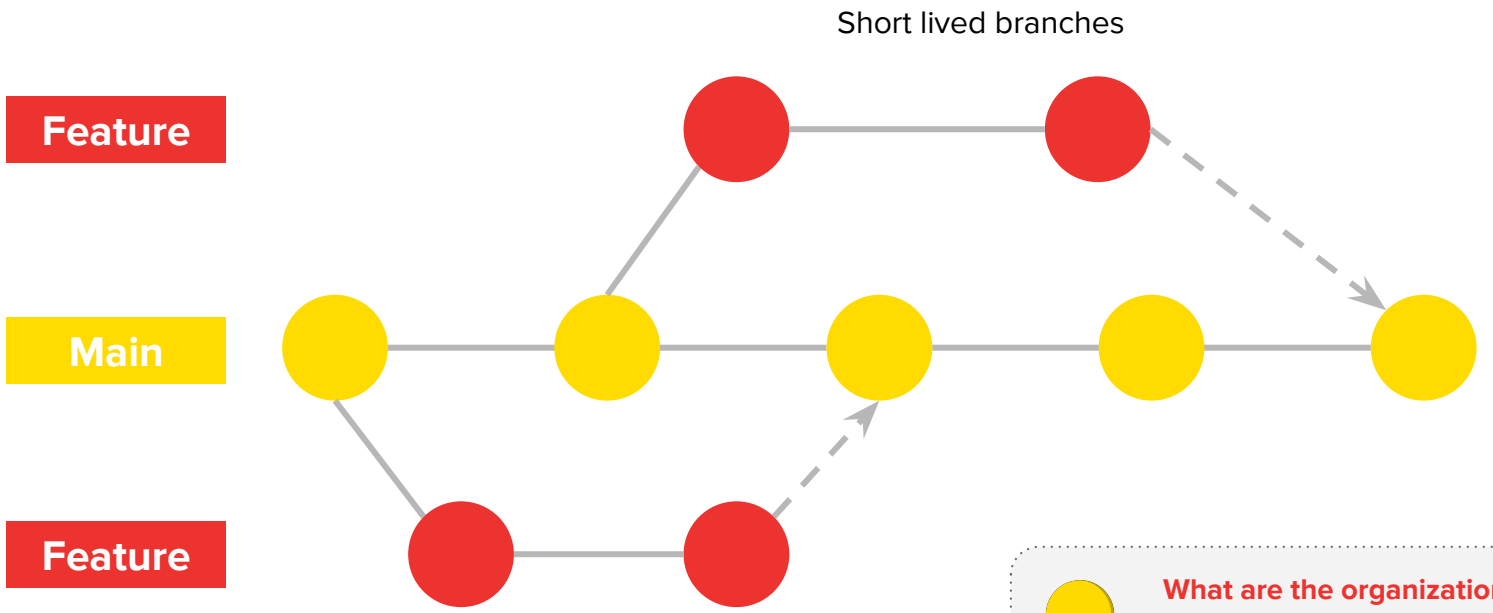
Feature Branches



Example of GIT Workflow

Source: Atlassian Git Tutorials

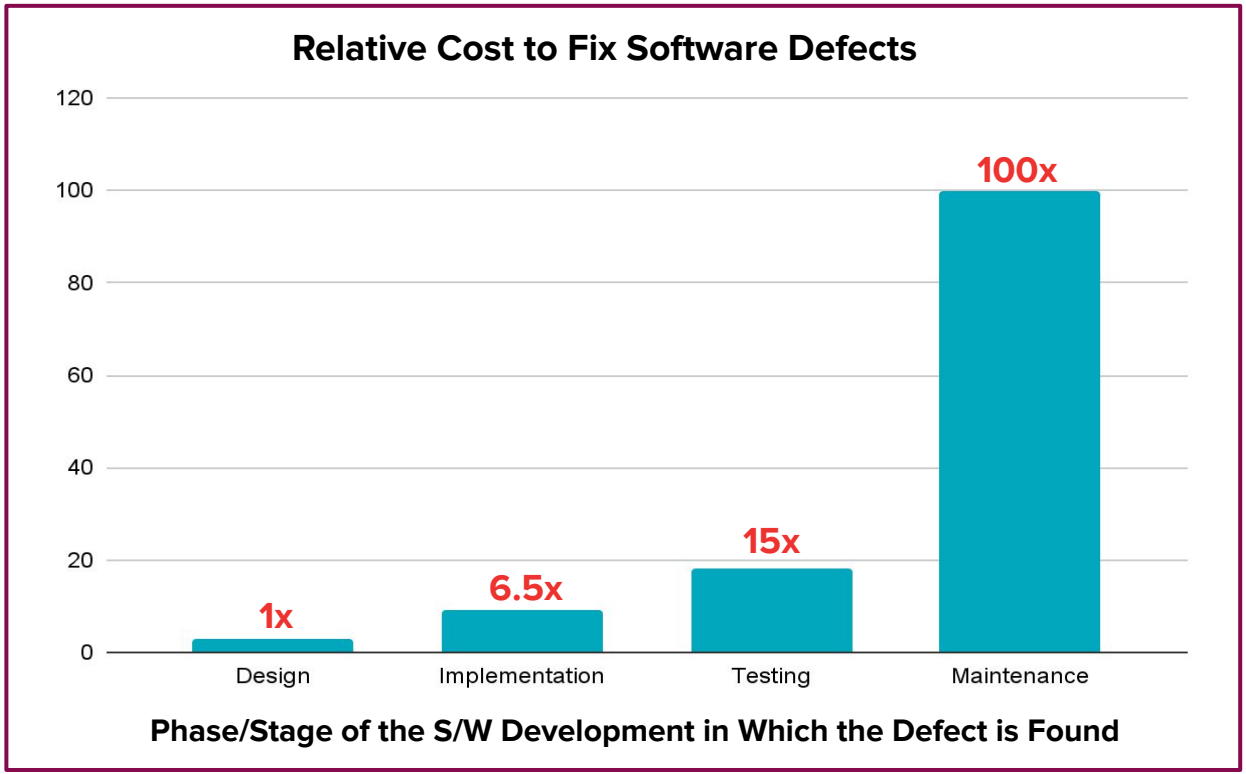
Trunk Based Development



What are the organization's requirements to implement trunk-based development?

Source: Atlassian Git Tutorials

Visualized



Source: IBM Systems Sciences Institute

Real Cases:

Why is CI/CD Important?

SAMSUNG

This concept is fundamental to why we do CI/CD. Let us discuss a real-world example:

Ever heard of the Samsung Note 7 fiasco? Note 7 phones had a faulty battery management system that caused them to catch on fire. They would have saved so much money if they had caught the bug in the early stages of development.

Can you guess?

How much do you think this particular bug ended up costing Samsung?

Real Cases:

Why is CI/CD Important?

SAMSUNG

This bug cost Samsung nearly $17 billion!

If it had been caught it earlier, they could have saved their reputation and many headaches.

This is why CI/CD is important.

Continuous Delivery

Continuous Delivery

Continuous delivery (CD) is an approach that builds on continuous integration. CD ensures that our code is always in a deployable state, even with thousands of developers making changes regularly. Teams produce software in short cycles so they can release the software whenever necessary. CD helps teams save time and money and makes delivering changes less risky.

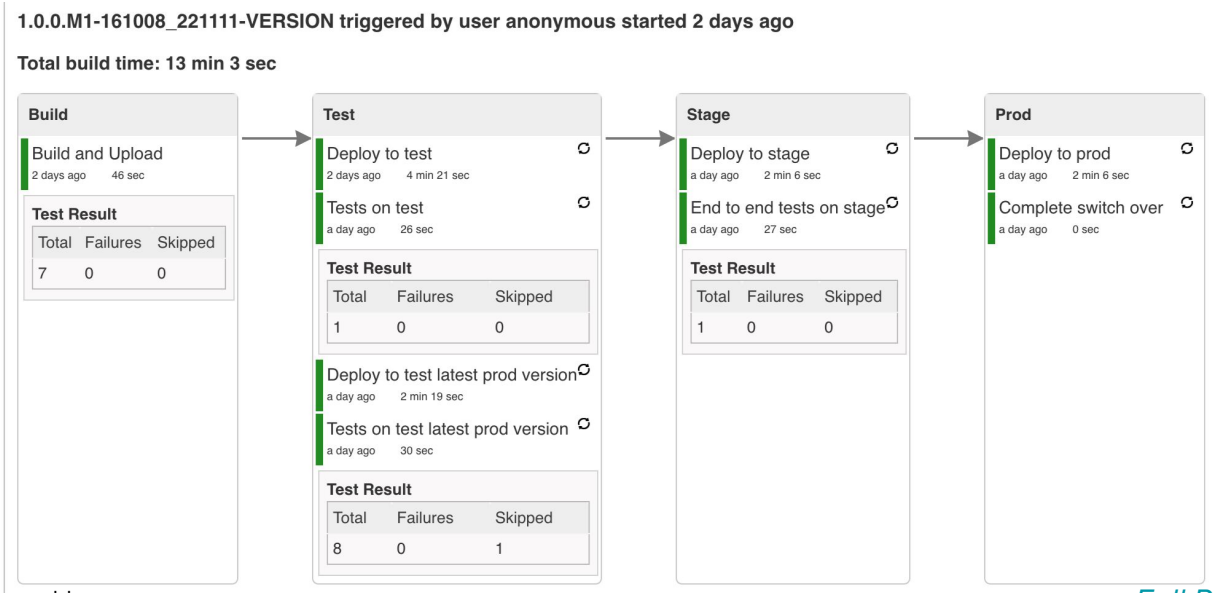
Development, Staging, and Production Environments

In most enterprises, there are several different environments where a new version of the application (a release candidate) needs to be built, tested, and/or reviewed before deployment to the production environment.

1. Build: Oftentimes, you'll see a build environment where the code is compiled and application artifacts are constructed (e.g., an rpm, war file, or image). Sometimes, unit tests will run here, too. Once built, the artifact is pushed to a repository and should never change.
2. Test: The artifact would then be pulled from the repository and installed in a test environment for integration testing, performance testing, and other testing purposes.
3. Stage: A staging environment is the last environment before promoting the artifact to production. That's where more tests can be run (automated or not) and/or human users may perform some kind of acceptance testing.

Development, Staging, and Production Environments

In CI/CD, this whole process — including deployments from build to test to stage and (optionally) to prod — should be automated by your build pipeline. Here's an example of what that pipeline might look like in Jenkins:



[Full Pipeline View]

The Other CD

In some companies, there will need to be a final approval or review by a human before software can actually be deployed to production. If that isn't the case, you can also fully automate that final deployment step (a practice known as continuous deployment).

Continuous delivery ensures that code can be rapidly and safely deployed to production and that applications function as expected through rigorous automated testing.

Continuous deployment is the next step of continuous delivery: Every change that passes the automated tests is deployed to production automatically.

Discussion:
Continuous Deployment

Knowledge check: *When is continuous deployment helpful? When might you not want to use continuous deployment?*

CI/CD

Build Pipelines

How do we catch bugs early?

You catch bugs by **testing early** and **often**.

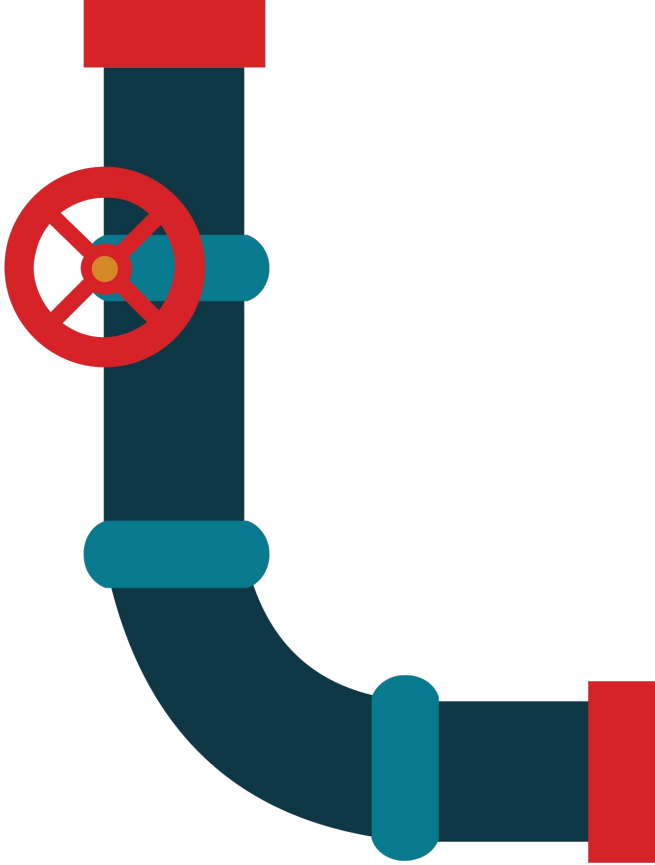
Most modern software development teams run tests automatically when there is any kind of change to the code.

Build Pipeline

A **build pipeline** is a set of automated processes that work together to build, test, and deploy software applications.

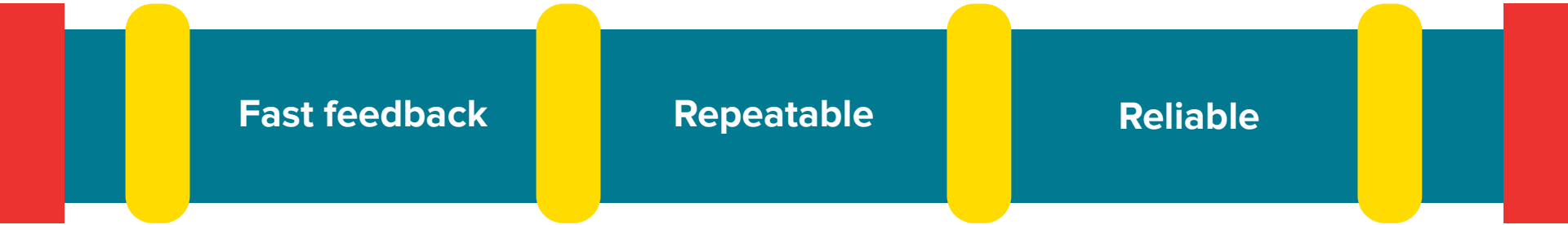
When a code change is detected, a build pipeline can build the application and test it.

Pipelines can have stages, and each stage can have steps. These steps can be configured to run your commands and shell scripts.

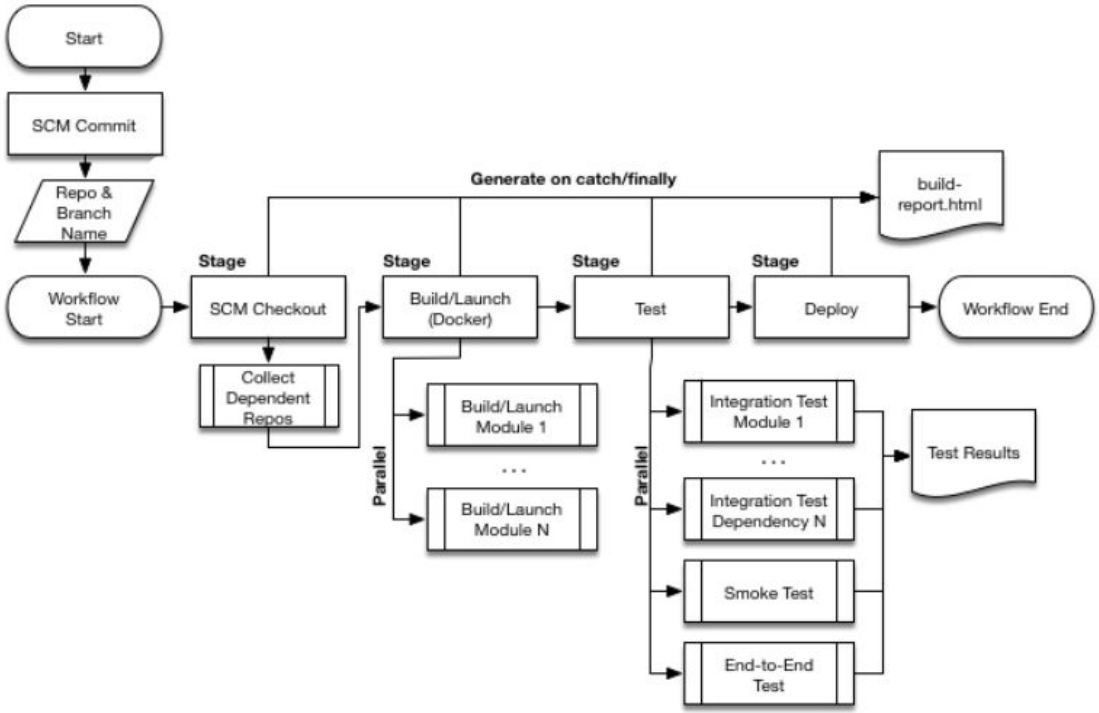


Characteristics of a build pipeline

Some features we want for our build pipelines:



The Deployment Pipeline



Source: Jenkins.io

Break Time

Jenkins CI/CD

Jenkins

Jenkins

Jenkins is an **open source automation server** used for building, testing, and deploying applications.

Jenkins is a tool built to enable **continuous integration.**

It's the most widely used tool for CI/CD in the industry.

It's high extensible, supporting a wide range of **plugins** for customization.

Important to note, it also supports the creation of **complex build pipelines**.

Group Exercise:

Researching Jenkins

15 minutes

Let's do some Jenkins research. With a partner, take a look at the Jenkins documentation (or other Jenkins resources).

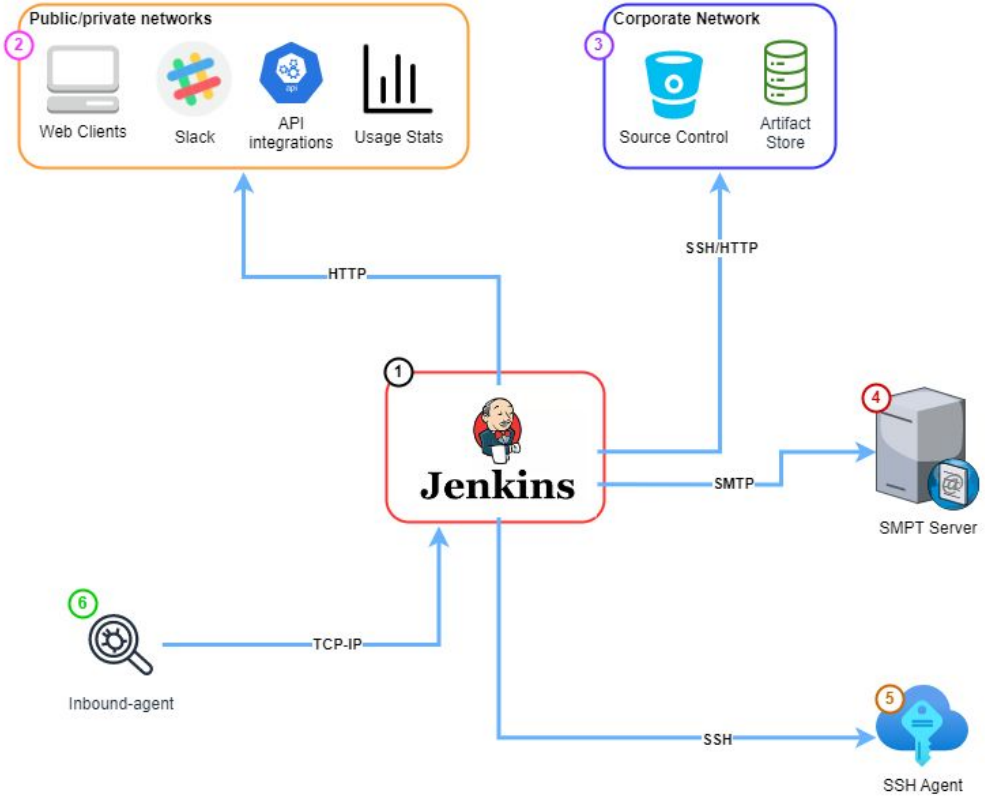
Answer the following questions:

- How does a Jenkins pipeline work?
- What is a Jenkinsfile?
- What's the difference between a **declarative** and **scripted** Jenkins pipeline?

After researching, be prepared to share out your answers.

Source: Jenkins Documentation

Jenkins high level architecture



Jenkins Plugins

Jenkins

A core feature of Jenkins are plugins, which allow you to extend Jenkins' basic functionality.

Some common types of plugins:

- Source Code Management (SCM) Plugins
- Build Tool Plugins
- Testing Plugins
- Deployment Plugins
- Monitoring Plugins
- Code Quality Plugins

Source: Jenkins Plugins

How to I build my pipelines?

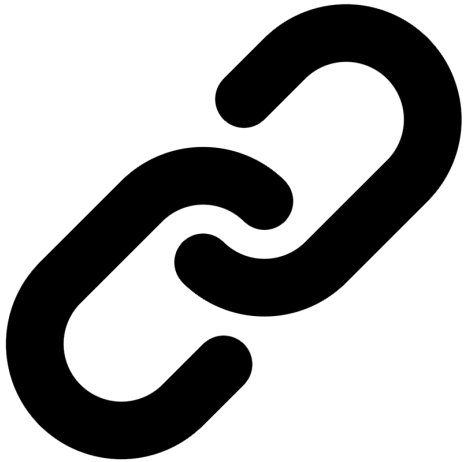
One way to build your pipeline in jenkins is to build your pipelines inside of **Jenkinsfiles**.

Pipelines allow for **more complex configuration** and **git versioning**!

```
pipeline {
    agent {
        docker {
            image 'node:lts-bullseye-slim'
            args '-p 3000:3000'
        }
    }
    stages {
        stage('Build') {
            steps {
                sh 'npm install'
            }
        }
    }
}
```


Repositories and Nexus

Once your application is built, your **application artifact** will be deployed to a repository such as **Nexus.**
By uploading the artifact to Nexus, the next stages in the pipeline can actually run on different servers and pull the artifact from the repo to operate on it.
Nexus also offers other features for dependency management and audit controls.



Guided Walk-Through:

Jenkins and Docker Instructor Walkthrough

Instructor will walk through Jenkins CI/CD Pipeline no need to code along.

Break Time

Guided Walk-Through:

Adding Jenkins to Our To-Do App

Together, let's add a Jenkins CI/CD pipeline to our model To-Do Application, including some automated testing commands that ensure a git push will be blocked if the tests are failing.

Solo Exercise:

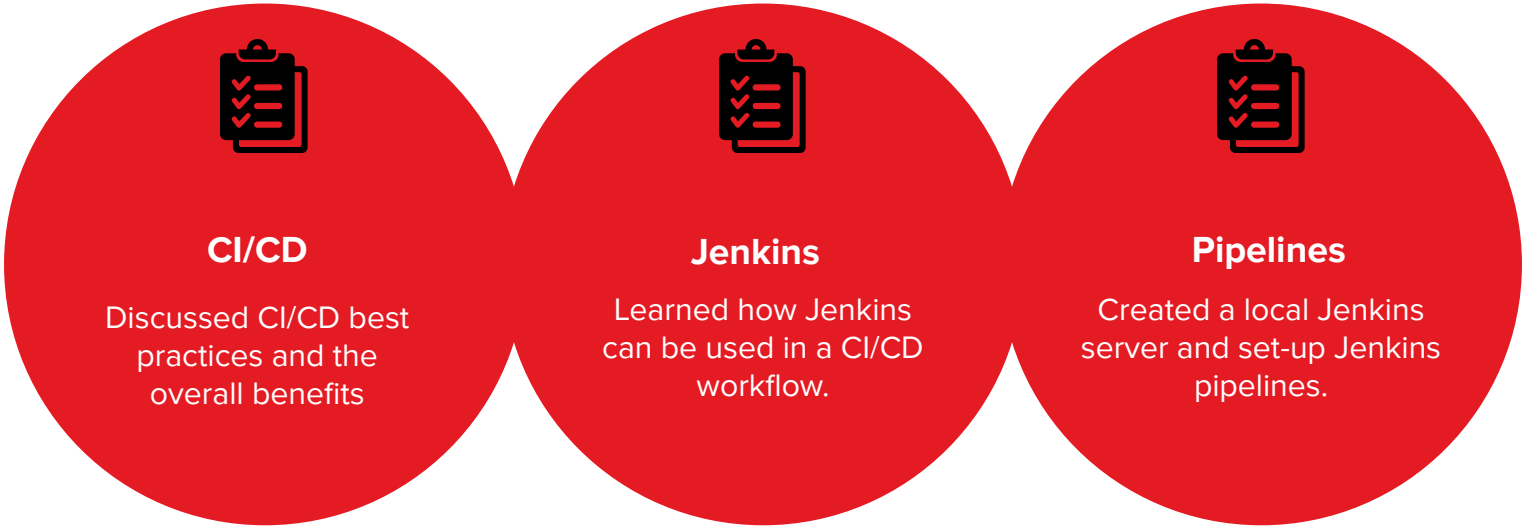
Add Jenkins to Your API (optional)

120 minutes

Take the API you've built and add a Jenkins build pipeline that executes automated testing before allowing a push to the git repository.

This will require a lot of consulting the documentation and research!

Recap



Solo Exercise:

Complete Docker Lab

Remainder of day

For the remainder of today's session, you'll have time to complete or enhance the Docker Lab

This will be the final evaluated lab before the final project begins soon!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